

C-6.13 Use the calculated molality of a solution to calculate the freezing point depression and the boiling point elevation of a solution.

Revised Taxonomy Level 3.2 C_A Apply (use) procedural knowledge

Students did not study this concept in physical science

It is essential for students to

- ❖ Calculate the concentration on a solution in terms of molality (m)
 - moles of solute per mass of solvent
 - moles/kg
- ❖ Calculate the freezing point depression of a nonelectrolyte solution using the equation:
 - The change in freezing point (Δt_f) of a solution is equal to the molal freezing point constant (K_f) times the molality of the solution (m).
 - ($\Delta t_f = K_fm$)
- ❖ Calculate the boiling point elevation of a nonelectrolyte solution using the equation:
 - The change in boiling point (Δt_b) of a solution is equal to the molal boiling point constant (K_b) times the molality of the solution (m).
 - ($\Delta t_b = K_bm$)
- ❖ Understand that the boiling point elevation or melting point depression of an electrolyte is dependent upon the number of moles of particles in the solution.
- ❖ Calculate the melting point elevation or boiling point depression of electrolytes
 - Determine the number of moles of particles in solution per moles of solute (molality conversion)
 - ◆ $(\text{NH}_4)_2\text{S}_{(\text{aq})} \rightleftharpoons 2\text{NH}_4^+_{(\text{aq})} + \text{S}^{2-}_{(\text{aq})}$
 - ◆ 1mole \rightleftharpoons 3 moles
 - ◆ molality conversion is 3moles/1mole
 - ($\Delta t_f = K_fm \times \text{molality conversion}$)
 - ($\Delta t_b = K_bm \times \text{molality conversion}$)
- ❖ Understand that the predicted value for both freezing point depression and boiling point elevation will be greater than the actual values due to deviation of real solution behavior from ideal solution behavior.

Assessment

The revised taxonomy verb for this indicator is implement (use), the major focus of assessment will be for students to show that they can “apply a procedure to an unfamiliar task”. The knowledge dimension of the indicator, procedural knowledge means “knowledge of subject-specific techniques and methods” In this case the procedure for determining the freezing point depression or boiling point elevation of both nonelectrolytic and electrolytic solutions. A key part of the assessment will be for students to show that they can apply the knowledge to a new situation, not just repeat problems which are familiar. This requires that students have a conceptual understanding of colligative.